

December 14, 2011

From: Arthur Jonath and Richard Goldwater

Dear Reader,

Economists take for granted that Supply and Demand are forces that balance each other in a version of Isaac Newton's Law, "every action causes an immediate, equal and opposite reaction". We propose that is more plausible to compare an economy to an engine than to a frictionless pendulum, which Newton's laws properly describe. We adapt our approach from the 19th Century science of heat and work called Thermodynamics, and call our approach Thermoeconomics.

The economic shocks of 2008 and their reverberations make it clear that we cannot rely on the "Free Market" and the "Law of Supply-and-Demand" to protect us from economic danger. We offer an updated, scientific approach to economics that need not inspire the ideology of either the political left or right.

Our major points are these:

- An internal combustion engine releases heat energy from fuel, accomplishes work, and generates waste.
- A temperature gradient between ignition and its cooling system must exist for an internal combustion engine to operate.
- Currency is economic fuel that contains units of energy called dollars.
- An economic engine releases economic energy from economic fuel, accomplishes work, and generates waste.
- It is possible and useful to calculate Buyer and Seller, *economic temperatures*.
- A sustained, economic temperature gradient between a warmer Buyer and a cooler Seller drives macro and micro, economic activity.
- Acting to sustain a Buyer-Seller temperature gradient can replace relying upon the Law of Supply and Demand.
- Maximum profits are predictably associated with the steepest, Buyer-Seller economic temperature gradients.

Earlier attempts to incorporate Thermodynamics into economics failed because:

- a) no definition of economic temperature accounted for actions of the "rational actor"
- b) such theories were based on price, not profit.

Our work eliminates both inadequacies.

We conclude among other things that a Non-Value Added Tax (NVAT) on financial profits can simultaneously cool and stimulate our economy. Our thermodynamic modeling prepares a reader for, and substantiates our conclusions.

Short article #1:

Introduction to “Beyond Supply and Demand”

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It is time to admit that ideological reliance upon the Law of Supply and Demand is responsible for our unending economic calamities. A revision of economic science will suggest how to facilitate recovery while avoiding bubble inflating and bursting cycles.

The law of supply and demand at the heart of contemporary, “free market” economics has come down to us unchanged from Adam Smith, who wrote in 1776. This law describes Supply and Demand as opposing economic forces that tend to balance and as they do, stabilize prices. Not by accident, Smith’s law resembles Newton's Third Law of Motion -- that every action generates an immediate, equal and opposite reaction.

During the 18th Century Enlightenment, Newton’s laws of conservation and balance seemed to apply universally, so it was only natural to model enlightened economics on Newtonian science. Newton’s laws describe the unfueled, perpetual motion of planets in orbits, motion which is possible because gravitational and centrifugal accelerations balance each other. Newton’s laws also describe perfectly the balanced recoil of a rifle firing a bullet. Newton’s laws do not however obviously explain why one cannot ignite the same gunpowder twice. Newton’s laws do not fully describe anything that uses and uses up fuel to keep moving – such as a human body, an automobile engine, or an economy.

In the 19th Century, a new science of heat and work addressed the burning fuel problem. The Second Law of Thermodynamics proved that a quantity called entropy cannot be conserved. Entropy represents heat released from fuel that must be wasted -- dissipated -- as heat flows from hotter to cooler; no engine can perfectly harness energy. Entropy increases without balance anytime there is heat-transfer, which is just about anytime anything happens, with or without an engine. Newton’s laws describe perfect balance, and the sense of up and down. Increasing entropy accounts for the sense of irreversible, “forward time”; increasing entropy is known as the “arrow of time”. Together, Newton and Thermodynamics more or less completely describe our everyday world.

Most high school and college science education does not teach much about thermodynamics. Most students of economics and business are not required to learn anything at all about physical science after high school. As a result, economists can believe that 18th Century certainty justifies “supply and demand” as a scientific principle. Free-marketeers blame the failure of their economic science to predict economic events on the irrational behavior of humans. This ought to be a clue that contemporary economics can claim no resemblance to objective, natural science.

Leaving illogical people and logical science out of the equations, supply-and-demand still poses the problem that it is a theory of price, not profit. Supply-and-demand identifies profit as “market inefficiency”, like friction in an engine. Without a primary theory of profit, one cannot understand the economic effects of profit-driven finance, like super-computed, High Frequency Trading. Without a theory of profit, one cannot understand why the “invisible hand”, or the “genius of the free market” did not prevent the events of 2008.

Our replacement model is more thermodynamic than Newtonian. We call it thermo-economic, and compare an economy to an engine.

An engine puts some of the heat energy released from fuel into cycles of work, but as we noted, necessarily wastes some of that energy as “increasing entropy”. We describe money similarly. Money is economic fuel that a sale sparks to release dollars of energy to flow across an economic temperature gradient from a warmer Buyer to a cooler Seller.

That portion of a sale price that recovers costs-to-market performs “economic work”. Recovery of costs-to-market completes an economic work cycle, because it returns people to work on the next production cycle. Price in excess of cost-to-market recovery is profit. Carefully to compare an economy to a fuel-burning engine suggests that profit is analogous to waste heat – in other words, to increasing entropy. Supply-and-demand economics correctly calls profit “inefficiency” – but there is no such thing as Newtonian inefficiency. Inefficiency is a thermodynamic idea.

Associating profit and entropy changes our perception of profit from the holy fuel of new investment to a waste product of healthy economic activity. It follows from this perception that a stable economy must not seek to amplify profits with finance. Rather, investment in new production effectively sequesters profit in the new value created by new energy, new labor, and new ideas. Of course, the next production cycle produces even more entropy; all one can hope for is economic growth attuned in some way to new supplies of free energy that arrive on earth every day from the sun, as well as to the ability of the environment sufficiently to dissipate into outer space the waste heat that all of our activity generates. Unregulated financial legerdemain fails to recycle profits into value, and instead manipulates profits to make more profits. The result is a tendency toward the uncontrolled price inflation that leads to profit bubbles and crashes.

Even the most elementary thermo-economic model replaces economic ideology with the kind of science that made possible the industrial revolution and the computer age. Understanding the relation of value production to profit production will empower economic scientists to tune the economic engine to maximum efficiency, just as engine mechanics can tune an engine to maximize its efficient work output.

We do not propose a system of micromanaging regulation that inhibits innovation and productivity. Our initial proposal consists of a simple tax on what we identify as non-value profits. These are profits related to financial manipulation, not to value production. We believe that such a system will leave plenty of room for wealth generation without appropriating the assets of the middle class.

Short Article #2
Introducing Economic Temperature

Currency and Flow in Economics

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Abstract: We suggest that a warmer Buyer to cooler Seller economic temperature gradient is a more useful economic model of the behavior of currency than is the Law of Supply and Demand. We explain briefly the scientific justification for this revision, and consider some of the implications.

Current is *flow across a gradient*. Rivers are currents of water that flow downhill. Currents of electricity flow from one pole to another. Heat flow is a current of thermal energy across a warmer to cooler, temperature gradient.

Currents flow across gradients *toward equilibrium*. Flow continues until a gradient “evens out”; for example, hot water mixes in a cool tub until all the water is lukewarm. Because flow across a gradient is toward equilibrium, *flow is irreversible*. Rivers will not spontaneously flow uphill, and heat will not spontaneously flow back from lukewarm to previously distinct, hotter and colder temperature zones.

Cash is fuel that releases its energy when ignited at a point of sale. When a Buyer pays more than the cost to bring to market, currency flows across a Buy-Sell, “economic temperature” gradient, driving micro- (personal) and macro- (international) economics.

Free Market economists recognize no vital, Buy-Sell flow. Rather, they perceive that forces called Supply-and-Demand seesaw at each other across a fulcrum, as though an “invisible hand” guides them toward an ideal equilibrium of stable prices. During the crisis of late-2008, the fulcrum vanished. Seesawing ceased, and economic equilibrium was revealed to be a state of paralysis, and no ideal at all. If two people on a playground seesaw of equal weight pause at equilibrium, their play ceases until an outside force (like a stimulus package) can tip the balance, and start them moving again.

Idealizing equilibrium generates dysfunctional ideas. Because the supply-demand ideal aims at zero-sum, free marketeers imagine that they must have a balanced, zero-sum federal budget. In their zeal, some want to tax the rich, while others want to cut spending for the poor. These are equally plausible, in supply-and-demand terms. Because supply-demand flow is deemed reversible, a “free market” might as well be either “supply-side” (driven by Federal Reserve policy and tax cuts to investors) or “buy-side” (driven by graduated taxation and consumer spending). Those who prefer to protect investors because they “provide jobs” (an unjustified assertion; economies are consumer-driven), reveal themselves as elitist and hierarchical at heart, rather than as freedom-loving and egalitarian; the free market is in their sly interest, and not in the interest of most people.

Balancing a federal budget when an economy is running well reduces debt interest payments, and puts money to work creating everyday value. It is counterproductive however to balance the budget by cutting spending when an economy is near equilibrium (as it is now). We need to protect and enhance the Buyer-Seller gradient, even if it means borrowing more or taxing the rich. Running out of gas with no cash in Death Valley, one must call for help and use a credit card.

Instead of supply-and-demand, it is easy and sensible to base economics on an *economic temperature* gradient. Although it may startle many to learn, any temperature scale rising from absolute zero is valid in Thermodynamics. Because *all we require is relativity to absolute zero*, we can define a subjective, psycho-thermo-economic temperature scale of Buyer desire or *economic libido*, and still treat economic interactions objectively. We do not need to measure these temperatures precisely; we just need to know that one side of a gradient is in a hotter state than the other. “Economic libido” is the microeconomic equivalent of the well-known but imprecise, macroeconomic measure: consumer confidence.

Strictly speaking, there is no subjective *energy*; libido is not physically measurable. Not energy, but *information* (like in-store displays or sexy ads) sustain and maximize the Buy-Sell gradient in a consumer economy.

Joules are units of physical heat. We compare dollars as units of currency to joules as units of heat. When Buyer-Seller temperatures meet at a sale price, dollars of “hot cash” flow across the gradient, heating the Seller, and releasing the object to the Buyer. If the price of a horse is \$200, and its cost-to-market is \$150, then \$150 covers costs. The remainder is profit.

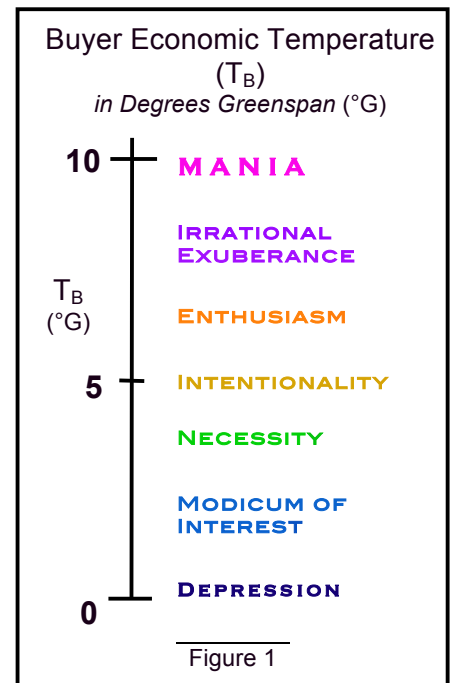
Figure 1 estimates grades of *Buyer Economic Temperature* as T_B . Just as 100° Celsius span freezing to boiling water, 10° Greenspan span economic liquidity. Temperatures range from frozen Depression at Zero to vaporizing Mania at 10°G. Alan Greenspan is a former Chairman of the US Federal Reserve Bank.

Intentionality -- rational choice -- is central. Necessity implies less desire; one buys what one must. (“Necessity” is how a child feels who gets underwear for Christmas.) That Necessity ranks below Intentionality suggests why we did not protect New Orleans, and why climate control is a hard sell. Modicum of Interest needs a very hard sell to raise Buyer temperature; Depression means staying in bed.

Above Intentionality, rationality melts into Enthusiasm for fads and fashions. Higher temperatures lift a Buyer from Enthusiasm into Irrational Exuberance, the term popularized by Alan Greenspan during the dotcom bubble. Further above, Exuberance yields to Mania. Precarious gambling on real estate or assuming wild credit card debt qualify here.

The Consumer Confidence Index (CCI) represents average macroeconomic Buyer Temperatures. Figure 2 below shows its flow over the past 12 years. For comparison, we estimate our micro-economic equivalent temperatures in °G on the right-hand scale.

Starting from the end of dotcom, Irrational Exuberance in Q-1 2000, average Buyer temperatures fell until they bottomed out at 3°G, aka Necessity, in 2003. During the subsequent 4 years, average Buyer temperatures recovered to hover around 5.5°G, from Intentionality to Enthusiasm, but never reached the high temperatures of the dotcom days.



Since mid-2008, we have seen both the lowest and the longest low CCI on record. We estimate the fluctuation as from 1°G to 3°G -- between Depression and Necessity. Consumers barely care to meet their needs, despite Sellers' price reductions.

Figure 2. U.S. Consumer Confidence Index (2000 - 2011)



Briefly to discuss Seller Temperature, and the Buyer-Seller temperature gradient, we refer to “increasing entropy”, a concept in Thermodynamics that we (and many others) explain elsewhere. All we need to know here is that a physical system generates increasing entropy as it approaches equilibrium. A system far from thermal equilibrium (in which there are distinct, hot and cold areas) generates more entropy en route to equilibrium than a system that is already close to equilibrium. Similarly, an economic transaction across a wide Buyer-Seller, economic temperature gradient will generate more profit than will a transaction across a small Buyer-Seller gradient.

The notion of economic temperature applies in everyday, economic situations.

Steve Job’s Apple Corporation exemplifies low Seller temperature, which is partly why customers think Apple products are “cool”. Apple does not segment markets by offering “hot” new products at every price point. Apple never appears in a hurry to sell anything. Apple product development secrecy maintains the “cool”.

At the same time, Apple keeps customer temperature in a high Enthusiasm range, maintaining a steep, economic temperature gradient between warm Buyer and cool Seller, producing high profits. New product presentations build excitement as though Apple were Santa Claus bringing Christmas gifts to good boys and girls. Perhaps part of Steve Jobs’ success was related to his life as an adopted child. He wanted Apple products to be lovable, and to find loving homes.

Here is an example of a nearly flat gradient. We know of an inventor of a new method to ascertain municipal water quality. He needs to sell his product, which might have enormous implications for public safety. Unfortunately, the inventor must sell his product into customer “Necessity”, which is below “Intentionality” on the temperature scale. There is no Enthusiasm here; none of his municipal customers Intends to buy his device. Few are even aware of any Necessity; most assume that things are fine as they are,

and would not want to admit it if they were not. With such a small Necessity-to-Necessity, Buyer-Seller gradient, our inventor is for now, dead in the water.

His story as well as those of the safety compromises that led to the recent New Orleans inundation and the Gulf of Mexico oilrig disaster all testify that safety is not sexy. Unfortunately, safety is as unsexy in finance as in physical situations.

Our third example is the worldwide financial near-Collapse of 2008. Unpoliced finance endangered the world economy, but citing greed as the root cause has not led to prosecutions, or to broad remedies. Risky, lucrative financial vehicles without obvious economic value still proliferate, especially those driven by High Frequency Trading (HFT).

We identify the problem not as greed, but as high Seller temperatures. By 2008, everyone was a Seller. Hot “default swaps” had wiped out the Buy-Sell gradient. A flat gradient means equilibrium, which means maxed-out financial entropy, which means no flow and no more profits. To the chagrin of believers in the free market, infusions of borrowed cash prevented a crash. The infusion went more to support Sell-side financial institutions than to support employment and consumer confidence. As a result, recovery is tepid, and financial risk has become “socialized” – the responsibility of the hapless public.

Buying drives the economy, not Selling. Employing consumers is good economics; employed consumers purchase goods and services. Poor and Middle Class consumers quickly spend a large fraction of their earnings on necessities. Their spent money changes hands quickly, putting more money immediately to work creating jobs.

The wealthy cannot spend their money fast enough. Financial flow to the wealthy makes its way conservatively into investment rather than spending. Investments have no intrinsic utility, like food. Investing is a kind of Selling, not of Buying. One Invests for the same abstract reason that one Sells: for profit, the benefits of which are long term.

If present unemployment rates continue, middle class earning and consuming capacity may decline permanently, and cause structural, economic damage.

Some argue that Sellers can use advertising to create Demand – that a consumer is a *tabula rasa* waiting to be inscribed; advertisers do not believe in free will. Despite the forces of neuro-advertising, a Buyer is not reliably a passive extension of the Seller. Successful marketing depends on subjectivity. It may be however that only an intuitive magician like Steve Jobs can think empathically “beyond the gradient”. Everyone else uses focus groups.

Accepting that currency flows across an irreversible, Buy-Sell gradient invalidates supply-side theories once and for all. Once one understands what it means that consuming drives economics, really new thinking is possible. We may even wonder: can there be true, economic democracy?

Short Article #3:

Economic Work, Profit, and Pleasure in Thermoeconomics

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Thermoeconomics compares an economy to an engine. Currency is fuel that releases energy to flow across an economic temperature gradient from a warmer Buyer to a cooler Seller. Here, we discuss economic work, profit, and a “pleasure principle”.

A cycle of *economic work* restores the conditions necessary for the next production cycle. The portion of a sale price that recovers costs-to-market does economic work, has economic *value*, but obviously just “breaks even”. *Worth* refers to perceptions that drive a Buyer’s willingness to pay a high, or at least a profitable price.

Now, we review some Thermodynamics. Fuel molecules store heat energy in complex molecular structure. The release of energy destroys the structure. Working engines cannot break even, nor re-create as much structure. Engines must take in more fuel energy often measured in joules, than it can output as work, which can also be measured in joules.

No matter how beautiful or efficient work is, waste happens. Molecular disorder overall increases, and is called *increasing entropy*. Virtually everything that happens in nature and civilization uses fuel, so entropy increases all the time. In fact, increasing entropy is time, the irreversible “arrow of time”. Just as gravity accounts for the sense of down, increasing entropy accounts for the sense of *forward time*.

Back to economics. If economics were just “breaking even”, we would live within a barter system. Bartering parties exchange objects of intrinsic usefulness. Barter is two-way Selling, in that both parties can feel that they have profited, but nothing necessarily leads to the next transaction. Each barter exchange takes place in its own present moment.

Currency converts intrinsic usefulness into cash, which is abstract value exchangeable for anything of similar price. If sale prices only recovered costs-to-market, we would remain within a barter system. An economic fuel model makes this impossible. Like fuel ignited in an engine, more dollars of currency must be expended to accomplish economic work than the cost of the economic work in dollars – the dollar amount of cost-to-market recovery. The excess fuel needed to accomplish physical work dissipates as increasing entropy. The excess currency needed to accomplish economic work dissipates as profit.

Profit as increasing entropy thus invents the irreversible future. A profitable transaction is “successful”, because another transaction can succeed it – can follow it in time.

If one asks an economist what is economic fuel, the likely reply is the subjective motivation of objective, economic “rational actors”. This would seem to agree with what we have proposed as subjective-objective, economic temperature scales. By motivation however, economists mean collective behavior, as they infer it from experimental and population data. Social science does not infer its general models from any identifiable person. Thermoeconomics works from the psychology of a subjective individual, much as a dramatist constructs from insight a character of general interest to an audience. We expect our holistic approach can augment market strategy as behavioral economics suggests it.

There can be no profit and therefore no thermoeconomics until somebody *buys*

something. So, we discuss the Buyer first. A Buyer is willing to pay a profitable price rather than to wait for a “better deal” because of *worth*. Worth is a perception or an expectation of product gratification as an *object of utility*.

Two orthogonal elements define utility. One is objective or intrinsic; a Buyer wants a horse to work the farm. A horse might also have subjective or social utility: to impress someone a man wants to marry. Drinking water when thirsty brings objective, physical pleasure. Drinking the same water from a branded bottle in a fancy restaurant may provide subjective, social status pleasure as well, and perhaps relief from social status anxiety. Advertising subtly blends these two expectations into a heady and hearty ambrosia.

The objective utility of warm coats in cold weather might matter. Not many may sell, however, without attention to coats as status symbol “fashion statements”. Advertisers and criminal hucksters know well how to blind Buyers with status flattery. Ponzi-schemer Bernie Madoff stole billions because he raised Buyer economic temperature, as he aroused social-status lust among his prospects, enticing them with favored “insider treatment”.

Insofar as economic temperature drives economic action, pleasure might simply be cooling down. As a Buyer-Seller gradient equilibrates however, a Seller would heat up and become commensurately uncomfortable. Then what? Temperature equilibration by itself is passive. A Buyer intends to Buy, and a Seller intends to Sell. We infer instead that economic motivation works according to an active “*pleasure principle*”. A pleasure principle operates along a *tension gradient* (felt as stress, pain, or anxiety) between unpleasure and pleasure. Both Buyer and Seller seek pleasure.

We identify emotional tension as the subjective equivalent of increasing entropy. In thermodynamics, rising temperature means that molecules of a fluid move about *more energetically* and *randomly*, increasing pressure upon their container. In thermoeconomics, as libido heats up people, libido increases emotional pressure upon contained behavior. Rising temperature affects molecular pressure precisely, but increasingly disorderly motion aka increasing entropy means greater imprecision about any molecule’s location. Rising entropy is thus location *information loss*.

To identify subjective tension as a mental equivalent of entropy, we note that rising economic temperature affects sensed “information status”. The emotional equivalent of increasing entropy is thus anxiety: what is going on inside of me? Am I flying apart?

Buying is pleasurable when it replaces anxiety with purpose. (“When the going gets tough, the tough go shopping.”) The traditional economic “rational actor” associates pleasure with survival – either physical or social. Sometimes it is as simple as, “I am going to die if I cannot buy that new iPad.”

Buyer tension does not simply vanish. It crosses the gradient to the Seller. Let us suppose that a Seller receives \$200 for a horse that cost \$150 to bring to market. The Buyer enjoys a horse’s worth of tension-reducing pleasure at the purchase. The Seller enjoys a horse’s worth of pleasure at getting rid of the horse – but also receives from the Buyer a *horse-plus* of tension: the cost of the horse, plus profit. Seller tension thus rises *more than* Buyer tension falls. The Seller appears worse off than before! The situation compares to what happens when a door opens between two equivalent rooms of different tempera-

tures. Temperatures meet at an average. Simple arithmetic shows however that entropy increases more in the previously cooler room (the Seller) than falls in the previously warmer room (the Buyer). Entropy does not “average out”. Entropy increases overall.

A Seller is not however a closed room. A Seller proceeds to reduce tension by spending proceeds to recover costs, to save, to invest, and to enjoy. A Seller thus experiences *more overall tension reduction* after a sale – by inventing the economic future -- than the Buyer did at the sale. *We conclude that Selling is overall, a greater pleasure than Buying.*

The implications are macroeconomic. Promotion may be necessary to incite the purchase of goods, especially if one might not really need them. (But, they were on sale!) One might however consider selling one’s children for the right price. So, we have today “gestational carriers” and “surrogate mothers”, etc. It is no wonder that there is still a sex-slave trade, and an illegal drugs industry. The profit motive has no more intrinsic morality than does a digestive system.

We take this opportunity to speculate about childhood psychology.

By six months of age, a baby has grown to recognize that the source of all safety and comfort (aka the mothering parent) is not itself. It seems plausible that this recognition of separateness sets up a sensed, unpleasure-to-pleasure gradient from a vulnerable “self” to an external, ideal “other”. Comforting oneself in Mother’s absence internalizes the gradient. Thumb-sucking is early behavior that pleurably reduces the internalized anxiety gradient toward equilibrium, replacing abject terror with manageable separation anxiety. Discovery of one’s thumb is a milestone on the path to autonomy.

Think of Baby as the original Seller. A successful baby smiles and cuddles, selling gratifying “self-esteem” to mother. Mother purchases baby-love with joules of fuel energy (aka “negative entropy”) via milk. Baby internalizes mother’s serene self-esteem along with the milk as its own self-love, and outputs evidence of their profitable business relationship in a diaper.

We may begin life as Sellers, but we become Buyers and enter the larger economy as we come to believe by age 3 (as advertisers well know), that acquiring an idealized object (Cocoa Puffs!) can abolish at least briefly the self-other, anxiety gradient. A T-shirt legend says it well, “Whoever has the most toys when he [or she] dies, wins.”

Over time, one replaces mothering with whatever “floats your boat”. Eating relieves hunger; company reduces loneliness; romance fulfills desire; shopping relieves “the blues”. We suspect a powerful link between anxiety and profitability. Advertising coyly insinuates the anxiety that a product promises to relieve; drink beer, feel better, get girls.

Closeness to mother is well known as the *anlage* of self-esteem based on social status. There is good reason why self-esteem can be nurtured or destroyed while one is matriculated in the arms of one’s high school or college “alma mater”. “To matriculate”, which means to join a group, derives its meaning from “mater”, or mother. For many of us, buying a Rolex or BMW “status symbol” is as close to mother as we will ever again get.

Short Article #4:

Seller Economic Temperature

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Abstract: We further develop the idea of Economic Temperature by introducing the concept of Complex Seller Temperature to reflect that Seller Temperature has both subjective and objective components. While a Buyer may be heated along a subjective axis of desire or libido, a Seller's temperature must include both subjective and objective measures typical to Seller realities. We suggest such a measure and then use simple mathematics to connect the resultant magnitude of the complex seller temperature to the Buyer-Seller temperature gradient. With the Thermo-economic equivalent of the Entropy Law, we may then calculate the effects of Buyer-Seller temperature gradient on margins resulting from sales.

Under Construction.

